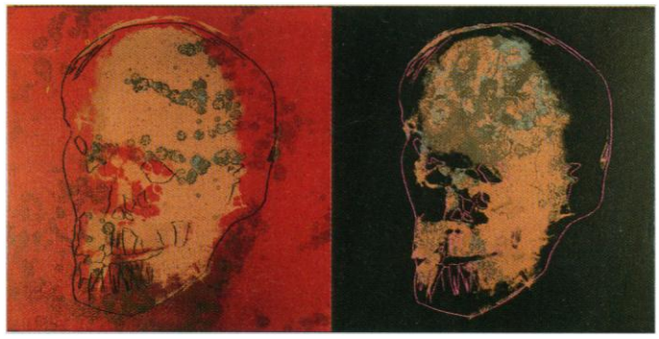
BOOK REVIEWS

X-Rays and Beyond

Naked to the Bone. Medical Imaging in the Twentieth Century. BETTYANN HOLTZMANN KEVLES. Rutgers University Press, New Brunswick, NJ, 1997. xvi, 379 pp., illus. $35.95. ISBN 0-8135-2358-3. Sloan Technology Series.

This deeply researched work firmly embeds its inherently fascinating story within a larger cultural matrix. After recounting Wilhelm Roentgen's accidental discovery of the imaging power of x-rays in 1895, Bettyann Kevles documents the new technology's rapid spread. As the news flashed around the globe, Roentgen's x-ray of his wife's skeletal hand, a ring clearly visible on the third finger, became an iconic symbol comparable to the mushroom cloud of 1945. By the 1930s, over 100,000 people were being x-rayed daily worldwide. Kevles chronicles the principal innovations in x-ray technology, including William Coolidge's "Coolidge [hot cathode] tube" and Walter Dandy's use of air as a contrasting agent in brain x-rays. (When George Gershwin's brain tumor was diagnosed in 1937, Dandy served as a consultant.) She also documents the gradual realization that this useful diagnostic tool could itself turn deadly, as radiologists and patients developed burns, lesions, and (ultimately) cancers. Banquets at radiological conventions became problematic because so many diners lacked fingers or hands to manipulate the tableware! In part 2, Kevles recounts the history of newer imaging systems, including ultrasound, CT (computerized tomography) scanning, MRI (magnetic resonance imaging), and PET (positron emission tomography). She nicely illustrates the advancing state of scanning technologies by noting the techniques employed by physicians treating President Garfield when he was shot in 1881, President McKinley in 1901, and President Reagan in 1981, when a CT scan saved James Brady's life.



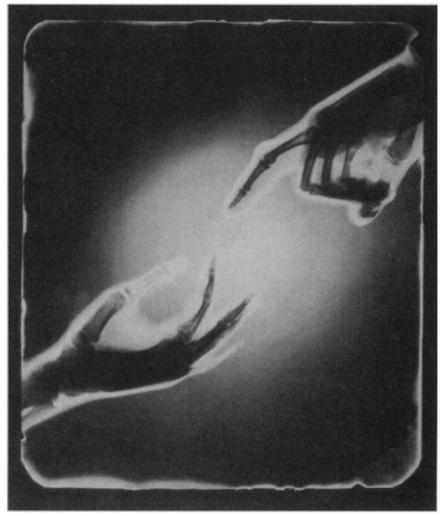
Philip's Skull (CAT Scan), by Andy Warhol (1985). Synthetic polymer paint, silkscreen, and urine on canvas. [From *Naked to the Bone*; © 1997 Andy Warhol Foundation for the Visual Arts/ARS, New York, photo by Richard Stoner]

As noted, Kevles roots her story in its broader cultural milieu. She shows the influence of two world wars on x-ray technology; explores the uses of x-rays in legal and forensic medicine; and, in two fascinating chapters, shows how x-rays captured the imagination of writers, artists, marketers, popular-culture producers, and ordinary folk. This process may be seen, she argues, in the work of avant garde artists from Picasso and Duchamp to Kahlo and beyond. Thomas Mann's memorable account of the x-raying of Hans Kastorp's tubercular lungs in *The Magic Mountain* (1924) is but one of many instances of writers' use of the x-ray's metaphorical possibilities. As early as 1897, in *The Invisible Man* (a tale that proved irresistible to moviemakers), H. G. Wells inverted the principle of x-rays to imagine a technology that would render human beings invisible. The creators of Superman in 1939 endowed him with "X-Ray vision"—a talent whose prurient potential Hollywood would later exploit. (Kevles comments interestingly on the gender implications of a new technology that gave predominantly male radiologists and physicians unprecedented visual access to the intimate recesses of the female body.) Meanwhile, several generations of children, including this reviewer, first encountered x-rays in shoestore "Foot-O-Scopes."

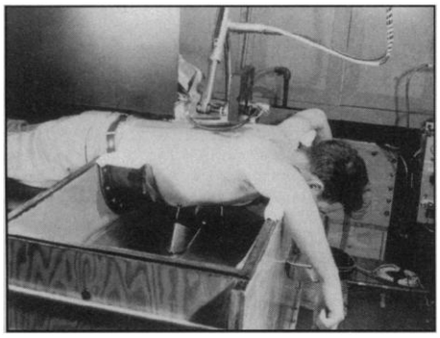
The book's final chapter, "The transparent body in late twentieth-century culture," chronicles contemporary cultural creations influenced by x-rays or other imaging systems. A ballet entitled *MRI* made its debut in 1994. The artist Francis Bacon drew upon the photographs in a 1939 x-ray textbook, *Positioning in Radiology*, in such paintings as *Head Surrounded by Sides of Beef* (1954). Robert Rauschenberg's *Booster* (1967) was a montage of x-rays of his own body. David Teplica's *Birth of Man with Homage to Michelangelo* (1987) offered an x-ray version of the familiar image of God's finger touching Adam's. Turning to another cultural arena, Kevles shows how new means of imaging human fetuses added powerful emotional resonance to the abortion debate. (The book's dedication to the author's infant grandson includes an ultrasound image of him in utero.)

Kevles also examines her story's economic and social ramifications, exploring the rivalries that have swirled around different imaging systems and making clear the centrality of cost calculations in current policy debates over highly expensive new techniques such as PET.

Naked to the Bone is not without problems. The level of detail, while commendable, is also daunting. The discussion of artists who have incorporated imaging into their work at times becomes something of a laundry list, with little attention to the importance of a given artist or the aesthetic quality of a particular work. (Some of the recent work Kevles discusses seems little more than psychedelic New Age kitsch.) Kevles sometimes conveys the impression



Birth of Man with Homage to Michelangelo (1987), by photographer and plastic surgeon David Teplica. Selenium-toned gelatin, silver roentgenogram, 16" by 20". [From *Naked to the Bone*; The Collected Image, Evanston, IL; courtesy of David Teplica]



Ultrasound breast scanner developed by John Wild, working in Minnesota in the 1950s and '60s. To produce images without causing tissue damage Wild adopted a "pulse-echo" technique that "enabled a single transducer to act as both transmitter and receiver, a melding of function that became basic to the emerging technology of ultrasound." Often enmeshed in controversy, Wild had fallings out with the sponsors of his research, and in 1962 the National Institutes of Health confiscated his equipment. At the time such research "evoked very little interest from the private sector." [From *Naked to the Bone*; courtesy of Barry Goldberg, Archives Committee, American Institute of Ultrasound in Medicine]

that the body's interior remained terra incognita until 1895, whereas in fact, through surgery, dissection, and anatomy drawings, the world beneath the skin had been known for centuries. But Kevles tells her basic story interestingly and well, and she makes a convincing case that the x-ray and its sequelae brought a revolution in perceptions of the human body that resonated powerfully in many realms of thought and culture. *Naked to the Bone* brilliantly explores that liminal frontier terrain where medicine, technology, economics, and culture converge and interact.

Paul Boyer
Department of History,
University of Wisconsin,
Madison, WI 53706, USA

■

Clinical Trials from Close Up

Between Bench and Bedside. Science, Healing, and Interleukin-2 in a Cancer Ward. ILANA LÖWY. Harvard University Press, Cambridge, MA, 1996. vi, 370 pp., illus. $39.95 or £26.50. ISBN 0-674-06809-2.

Conducting a clinical trial of a novel cancer therapy entails orchestrating the actions of many different individuals and organizations, including clinicians, bench researchers, nurses, cancer foundations, pharmaceutical companies, and government agencies, as well as, of course, cancer patients and their families. These diverse actors face the difficult and often unenviable task of doing science and making medical decisions in an environment where the most mundane activities are intertwined with matters of life and death and where no one can draw sharp boundaries among scientific, clinical, organizational, and ethical questions.

The goal of Ilana Löwy's study *Between Bench and Bedside* is to provide a probing description of the institutional complexities of this social world. To accomplish this, she spent about four years following the development of a particular clinical trial, conducted during the 1980s in Paris, where she sat in on group meetings, observed laboratories, and interviewed personnel. The trial was a high-profile test of interleukin-2 (IL-2), a molecule that to some mid-1980s observers represented an immunological strategy so novel and promising that it inspired visions of a spectacular turning point in cancer therapy. Although these hopes soon faded, by the early 1990s IL-2 had found a respectable place in the oncologist's arsenal, alongside many other treatments of real yet limited efficacy.

More than most areas of science, clinical research lends itself to melodramatic narratives, but Löwy is not interested in telling a simple story of heroes, villains, and victims. She explicitly rejects both "white" accounts (that uncritically report the views of the scientists who organized the trial) and "black" accounts (that describe how self-serving professionals and industrialists profited at the expense of patients). Instead, she sets herself to the far more ambitious task of understanding the trial as a social and historical phenomenon.

An important starting point for Löwy's analysis is the insight that cooperation among the participants in a trial cannot be assumed as a given but must be explained as an outcome. The immunologists, oncologists, and others who tested IL-2 did not always share precisely the same goals, and they approached the project with different conceptual and material "tool kits." Moreover, as Löwy points out, agreement among the investigators about "the broad outlines of collaboration did not always prevent friction over issues such as the right to use space and equipment, to employ technicians, to recruit patients, to change protocols, to supervise students' work, to obtain biological materials from the clinics, to control patient-derived substances, and to present authorized accounts of the trial." The suffering of patients, some of whom experienced terrible side effects, also contributed to the fragility of the trial, especially as the overall results began to suggest that miraculous cures would be infrequent.

To control tensions between the clinicians and the laboratory scientists, the trial organizers had to build shared understandings about which decisions belonged under whose control. According to Löwy, one means for achieving this was defining a zone of "intermediary" issues that were neither "clinical" questions for oncologists to resolve nor "immunological" matters solely in the bench scientists' domain. Because neither group could exert exclusive control over the intermediary zone, it became a shared space for negotiating about the authority to make decisions, the right to interpret trial results, and the distribution of professional rewards. Establishing an intermediary zone was only one of a set of social, discursive, and material techniques that Löwy argues served to routinize the actions of trial participants, deflect internal and external criticism, and allow work to proceed.

Löwy devotes roughly half the book to situating the trial in the history of cancer research. Using a structure somewhat reminiscent of a series of photographs at increasing magnification, she begins with a high-altitude look at the culture of clinical experimentation in oncology, then broadly surveys the history of cancer immunotherapy (with one chapter devoted to the period 1894–1979 and another to 1980–1990), and finally zooms in on the trial itself. By carefully setting the IL-2 trial in context, Löwy intends to illustrate how the institutions and practices that shaped the trial are embedded in larger historical processes. However, owing to their sweeping scope, the historical sections of the book seem loosely connected to her tightly focused examination of the IL-2 trial. Nevertheless, *Between Bench and Bedside* provides a view into the world of oncology trials that will interest scholars in science and technology studies and in the history and sociology of medicine.

Stephen Hilgartner
Department of Science and
Technology Studies,
Cornell University,
Ithaca, NY 14853, USA

■

Books Received

Biomedical Research. How to Plan, Publish, and Present It. William F. Whimster, with Gary Horrocks and David A. Heath. Springer-Verlag, New York, 1997. xxviii, 246 pp., illus. Paper, $24.95. ISBN 3-540-19876-8.

Bioremediation. Principles and Applications. Ronald L. Crawford and Don L. Crawford. Cambridge University Press, New York, 1996. xii, 400 pp., illus. $100. ISBN 0-521-47041-2. Plant and Microbial Biotechnology Research, 5.

The Blood Group Antigen FactsBook. Marion E.